MATHEMATICAL SCIENCES
(Mathematics 640, Statistics 960)

Web Site: *http://carp.rutgers.edu/math_undergrad/*

Major requirements in mathematics can be completed only through daytime attendance.

Department of Mathematical Sciences

Chairperson: Gabor Toth

Mathematics

Professors:

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Associate Professors:

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Major Requirements

Following are three options that students may choose according to their field of interest. It should be understood that these options specify a minimum requirement in each case. It is strongly recommended that they be supplemented by additional course work.

Students planning to specialize in Statistics 960 should contact the mathematical sciences department for a suitably designed program.

On admission, first-year students are assigned codes on the basis of a placement test in mathematics. The codes indicate readiness for regular math courses of various levels or the need for developmental courses (50:640:041-042). Students are required either to place out of the developmental sequence or to complete the sequence as prerequisite for any other course in mathematics, statistics, or computer science.

Students who are planning to take actuarial examinations are advised to contact the chair of the department.

Pure Mathematics Option

To qualify for the option in pure mathematics, a student must satisfactorily complete with a grade of *C* or better each of the following courses in the suggested four-year schedule:

First Year
50:640:121,122 Unified Calculus I,II (4,4)

Sophomore Year
50:640:221   Unified Calculus III (4)
50:640:250   Linear Algebra (3)
50:640:314   Elementary Differential Equations (3)
50:640:356   Theory of Numbers (3)

Junior Year
50:640:311-312 Advanced Calculus I,II (3,3)
50:640:351-352 Introduction to Modern Algebra (3,3)

Senior Year
50:640:403   Introductory Theory of Functions of a Complex Variable (3)
50:640:435   Geometry (3)
50:640:441   Introductory Topology (3)
50:640:491 *or* 492 Mathematics Seminar I,II (3)

Course 50:640:403 is offered in alternate years. Students pursuing the pure mathematics option should enroll in the course during their junior year if possible.

Deviations from the set program must be approved by the mathematical sciences department.

Applied and Computational Mathematics Option

The applied and computational mathematics track is designed for students with interests in mathematics and computer science. Students are taught mathematical ideas and methods useful for solving computational problems in science and engineering. Students majoring in computer science, or in other scientific disciplines, who have a strong interest in mathematics are encouraged to pursue a second major in applied and computational mathematics.

First Year
50:640:121 Unified Calculus I (4)
50:640:122 Unified Calculus II (4)
50:750:131, 133 Elements of Physics I, Elements of Physics Laboratory I (3,1)
50:750:132, 134 Elements of Physics II, Elements of Physics Laboratory II (3,1)

Sophomore Year
50:198:111, 112 Introduction to Computer Science, Software Lab I (3,1)
50:640:221 Unified Calculus III (4)
50:640:237 Discrete Mathematics (3)
50:640:250 Linear Algebra (3)

Junior Year
50:198:113, 114 Programming with Data Structures, Software Laboratory II (3,1)
50:198:271 Design and Analysis of Algorithms (3)
50:640:314 Elementary Differential Equations (3)
50:198:381 Introduction to Numerical Methods (3)

Senior Year
50:198:481 Advanced Numerical Methods (3)
50:640:358 Advanced Discrete Mathematics (3)
50:640:463 Partial Differential Equations I (3)
Applied and computational mathematics elective (3)

Elective Courses

50:198:316 Parallel Programming (3)
50:198:356 Computer Graphics (3)
50:198:458 Scientific Visualization (3)

50:640:427   Advanced Differential Equations (3)
50:640:497   Visualizing Mathematics by Computer (3)
50:640:498   Computational Mathematics (3)
50:640:499   Mathematics on the Web (3)
56:645:557   Signal Processing (3)
56:645:558   Queuing Theory (3)

For a minor in computer science a student needs to take the following additional two courses:

50:198:221   Programming Language Concepts (3)
50:198:231   Computer Organization and Assembly
             Language Programming (3)

Teacher Certification in Mathematics

Students seeking teacher certification in mathematics must complete the requirements for the major in the mathematics department as well as satisfy other requirements for certification. For details regarding admission to the teacher preparation program and its requirements, students should consult both their department advisers and the director of the teacher preparation program.

Minor Requirements

A minor in mathematics consists of a minimum of 18 credits of work, of which 9 credits must be at the 200 level or above, and 6 credits must be at the 300 level or above.

A minor in statistics consists of a minimum of 18 credits of work, of which 9 credits must be at the 200 level or above, and 6 credits must be at the 300 level or above.

Departmental Honors Program

The departmental honors program in mathematics is for students who are interested in pursuing individual study and research in particular areas of pure and/or applied mathematics. The honors program follows the general guidelines given under the Departmental Honors Programs in the Degree Requirements section of this catalog.

Students should have a grade-point average of 3.5 or better in courses in mathematics in order to be admitted to the program. Interested students, preferably in their junior year, should discuss the program with the Department of Mathematical Sciences and should obtain approval from the chairperson and the member of the department who is to serve as the student's adviser. At the end of the program, upon recommendation from the Department of Mathematical Sciences, the notation *Honors in Mathematics* shall be affixed to the permanent academic record of the student.

Courses (Mathematics 640)

Note: Some upper-level courses may be given in alternate years. Please check with department advisers.

50:640:041. ELEMENTARY ALGEBRA (NC)
For students who do not have the usual background in mathematics for college admission.
The system of integers, exponentiation, graphing, solution of equations, and basic notions of geometry.

50:640:042. INTERMEDIATE ALGEBRA (NC)
Prerequisite: 50:640:041 or placement by Basic Skills Test.
Study of algebraic operations on polynomials, integral and rational exponents, linear and quadratic equations, systems of equations, and the function concept.

50:640:103. FUNDAMENTAL MATHEMATICS SYSTEMS I (R) (3)
Particularly suitable for students of elementary education.
Sets, logic, number systems, and algebraic structures.

50:640:104. FUNDAMENTAL MATHEMATICS SYSTEMS II (R) (3)
Informal geometry, measurement, coordinate geometry, transformational geometry, and introduction to computers.

50:640:105. FINITE MATHEMATICS (R) (3)
Particularly suitable for business and economics majors.
Introduction to important and fundamental areas of mathematics that do not require calculus. Topics include set theory; functions and relations; and the algebra of vectors and matrices with applications to systems of linear equations, linear programming, and game theory.

50:640:106. AN INTRODUCTION TO MATHEMATICAL THOUGHT (R) (3)
Prerequisite: 50:640:042 or appropriate score on Mathematics Placement Examination. For the student who has serious interest in learning something about mathematical thought and its applications, but who is not planning to major in mathematics.
An understanding of the topics chosen for illustrating mathematical thinking within the reach of the student with the usual high school background.

50:640:108. NUMBERS AND BEYOND (R) (3)
Prerequisite: 50:640:042 or appropriate score on the Mathematics Placement Examination. This course is designed for students who are considering secondary certification. In addition, it also satisfies the 3-credit mathematics requirement for any other major.
Study of the properties and qualities of number systems and spatial relationships in geometry. Topics needed to explore the developmental beauty of mathematics discussed. Some are logic and reasoning; set theory and number theory; function (not limited to linear); sequences; basic concepts from calculus; group and field concepts; and spatial concepts, such as rotations, translations, and geometric objects.

50:640:113. PRECALCULUS FOR BUSINESS, ECONOMICS, AND BIOLOGY (R) (3)
Prerequisite: 50:640:042 or appropriate score on the Mathematics Placement Examination. Credit not given for both this course and 50:640:115. A non-required preparatory course for those students who must take 50:640:130.
A study of real numbers with regard to algebraic operations and order properties. Introduction to complex numbers and logarithmic and exponential functions.

50:640:114. TRIGONOMETRY AND ANALYTIC GEOMETRY (R) (3)
Elements of plane trigonometry and trigonometric identities. Plane loci, properties of the conic sections, and transformations of coordinates. The line, plane, and quadric surface in three dimensions.

50:640:115. PRECALCULUS COLLEGE MATHEMATICS (R) (3)
Prerequisite: 50:640:042 or appropriate score on the Mathematics Placement Examination. Credit not given for both this course and 50:640:113. A non-required preparatory course for those students who must take 50:640:121-122.
Algebraic expressions; algebraic equations; functions; graphing; and exponential, logarithmic, and trigonometric functions.

50:640:116. ELEMENTS OF CALCULUS (R) (3)
Students who plan to take more than one term of calculus should follow the sequence 50:640:121-122. Credit will not, in general, be given for more than one of the courses 50:640:116, 121, or 130.
A one-term survey of the elements of calculus, with emphasis on applications. Topics include elementary functions and their derivatives, rate of change, curve tracing, velocity, minimum and maximum, law of growth and decay, antiderivatives, and definite integral.

50:640:121. UNIFIED CALCULUS I (R) (4)
Prerequisite: 50:640:115 or accepted score on the Mathematics Placement Examination. Students who plan to take more than one term of calculus should follow the sequence 50:640:121-122. Credit will not, in general, be given for more than one of the courses 50:640:116, 121, or 130.
An introduction to analytic geometry, differentiation of algebraic and transcendental functions, applications of differentiation, and a brief introduction to integration.

50:640:122. UNIFIED CALCULUS II (R) (4)
Prerequisite: 50:640:121 or equivalent.
An extensive introduction to integration and the definite integral, transcendental functions, methods of integration, applications, and infinite series.

50:640:129. LINEAR MATHEMATICS FOR BUSINESS AND ECONOMICS (R) (3)
Prerequisite: 50:640:113 or accepted score on the Mathematics Placement Examination. A mathematics foundations course for the student majoring in business and economics.
Basic algebra, matrices, and linear programming with applications to problems in business and economics.

50:640:130. CALCULUS FOR BUSINESS, ECONOMICS, AND LIFE SCIENCES (R) (3)
Prerequisite: 50:640:113 or appropriate score on the Mathematics Placement Examination. Students who plan to take more than one term of calculus should follow the sequence 50:640:121-122. Credit will not, in general, be given for more than one of the courses 50:640:116, 121, or 130.
A one-term survey of the elements of calculus with emphasis on applications in business, economics, and life sciences. Topics covered are basic algebra, derivatives, maximum/minimum problems, integration, and partial differentiation.

50:640:182. ELEMENTS OF PROBABILITY (R) (3)
A one-term survey of the elements of the mathematical theory of probability with emphasis on applications. Topics include sets, subsets, Venn diagrams, partitions, independent events, sample spaces and weights, conditional probabilities, the binomial theorem, methods in combinatorial probability, the binomial distribution, and expected value.

50:640:190. INTRODUCTION TO HIGHER MATHEMATICS (R) (3)
Designed primarily for mathematics majors.
An encyclopedic survey of different branches of mathematics.

50:640:221. UNIFIED CALCULUS III (4)
Prerequisite: 50:640:122.
Solid analytic geometry, partial differentiation, multiple integrals, and applications.

50:640:237. DISCRETE MATHEMATICS (3)
Prerequisite: 50:640:113 or placement.
Sets, relations, and functions. Mathematical induction. Recursion. Propositional logic. Introduction to first order logic. Boolean algebra. Elements of combinatorics. Introduction to graphs and trees.

50:640:250. LINEAR ALGEBRA (3)
Prerequisite: 50:640:122 or permission of instructor.
Vector spaces, the calculus of matrices, and the theory of determinants.

50:640:300. MATHEMATICAL REASONING WITH PROOFS (3)
Prerequisites: 50:640:121 and 122.
Course develops two fundamental components of "writing mathematics": reasoning (thinking about the proof) and writing (formulating and writing the ideas precisely using logical statements). Begins with illustrative examples and general guidelines.

50:640:311-312. ADVANCED CALCULUS I,II (3,3)
Prerequisite: 50:640:221.
A study of convergence, uniform convergence, and continuity, with applications to series expansions in one and several variables; partial differentiation; multiple, line, and surface integrals.

50:640:314. ELEMENTARY DIFFERENTIAL EQUATIONS (3)
Prerequisite: 50:640:221 or permission of instructor.
Theory of ordinary differential equations. Power series methods and existence and uniqueness theorems. Applications to problems in economics, biology, chemistry, physics, and engineering.

50:640:331. INTRODUCTION TO ACTUARIAL MATHEMATICS (3)
Pre- or corequisites: 50:640:221, 250. Preparation course for the first exam of the college of actuaries.
Survey of calculus and linear algebra, with particular emphasis on topics such as complex exponents and logarithms.

50:640:345. MATHEMATICS ON THE WEB (3)
Prerequisites 50:640:121,122, 221, 250, or permission of instructor. Recommended also for students majoring in computer science as an elective.
Designed to get acquainted with using the World Wide Web for finding mathematical information and communicating mathematics.

50:640:351-352. INTRODUCTION TO MODERN ALGEBRA (3,3)
Prerequisites: 50:640:250 and 356 or permission of instructor.
The study of groups, rings, field, and linear spaces.

50:640:347. VISUALIZING MATHEMATICS BY COMPUTER (3)
Prerequisites: 50:640:121,122, 221, or permission of instructor. Recommended also for students majoring in computer science as an elective.
A comprehensive introduction to symbolic computational packages and scientific visualization through examples from calculus and geometry. Covers 2-D, 3-D, and animated computer graphics using Maple, Mathematica, and Geomview. No programming knowledge required.

50:640:356. THEORY OF NUMBERS (3)
Prerequisite: 50:640:122 or 132 or permission of instructor.
Properties of the natural numbers, simple continued fractions, congruences, and elementary arithmetical functions.

50:640:357. COMPUTATIONAL MATHEMATICS (3)
Prerequisite: 50:640:250 or permission of instructor. Alternate substitute for 50:640:356. Recommended also for students majoring in computer science as an elective.
Designed to emphasize the computational aspect of number theory. The most important topics to treat are the prime numbers, pseudo primes, and their applications, especially cryptography; prime factorization of composite numbers via several different methods explored. Computer simulation emphasized.

50:640:358. ADVANCED DISCRETE MATHEMATICS (3)
Prerequisite: 50:640:237.
Covers recurrent problems, generating functions: exponential and Dirichlet, number theory, special numbers, graphs, trees, asymptotics, difference equations, and other topics.

50:640:363-364. COMPUTATIONAL ENGINEERING MATHEMATICS I,II (3,3)
Prerequisite: 50:640:314.
Covers integral theorems of vector analysis, complex variables, series solutions to differential equations, Laplace and Fourier transforms, and use of mathematical software languages such as Maple and Mathematica.

50:640:368. MATHEMATICS FOR ECONOMIC AND BUSINESS ANALYSIS (3)
Prerequisites: 50:640:129 and 130.
Emphasizes the mathematical foundations of analysis in optimization of multivariate functions; differential and difference equations; linear programming; problems with particular consideration to business and economic interpretation.

50:640:375. FOURIER SERIES (3)
Prerequisite: 50:640:314.
Introduction to the solution of boundary value problems in the partial differential equations of mathematics, physics, and engineering by means of Fourier series, Fourier transforms, and orthogonal functions.

50:640:396. HONORS PROGRAM IN MATHEMATICS (3)

50:640:401. FOUNDATIONS OF ANALYSIS (3)
Pre- or corequisite: 50:640:311.
Introduction to basic concepts of topology and analysis, including point sets, uniform continuity, uniform convergence, compactness, metric spaces, Jordan curves, and the Riemann-Stieljes integral.

50:640:402. FOUNDATIONS OF ANALYSIS (3)
Prerequisite: 50:640:401.
Hilbert Space, Banach Space, Lebesgue integral, elements of functional analysis.

50:640:403. INTRODUCTORY THEORY OF FUNCTIONS OF A COMPLEX VARIABLE (3)
Prerequisite: 50:640:311 or permission of instructor.
Topological concepts, analytic functions, elementary conformal mappings, line integrals, Cauchy's theorem, Cauchy's integral formula, the calculus of residues. Taylor and Laurent series, normal families, Riemann mapping theorem, and harmonic functions.

50:640:410. VECTOR ANALYSIS (3)
Prerequisite: 50:640:221.
Vector calculus and its application to physics. Gauss, Stokes, Green theorems. Potentials.

50:640:427. ADVANCED DIFFERENTIAL EQUATIONS (3)
Prerequisites: 50:640:250 and 314.
Autonomous and nonautonomous systems of differential equations; phase plane analysis and stability of critical points; the perturbation method applied to nonlinear equations; modeling and analysis of environmental, biological, chemical, and economic systems. An article interdisciplinary in nature discussed in detail.

50:640:432. INTRODUCTION TO DIFFERENTIAL GEOMETRY (3)
Prerequisite: Permission of instructor.
Space, curves, curvature, torsions, Frenet formulas, curvilinear coordinates, fundamental forms, mean and Gaussian curvature, and the general theory of surfaces.

50:640:435. GEOMETRY (3)
Prerequisites: 50:640:121, 122, 221, or permission of instructor.
Euclidean and non-Euclidean geometries, geometric transformations. Complex language in geometry. Moebius transformations. Symmetries and tessellations. Projective geometry. Regular polytopes.

50:640:441. INTRODUCTORY TOPOLOGY (3)
Prerequisite: Permission of instructor.
A study of the standard topics of the set theoretic topology.

50:640:463-464. PARTIAL DIFFERENTIAL EQUATIONS AND BOUNDARY VALUE PROBLEMS (3,3)
Prerequisites: 50:640:363-364.
An advanced course in methods of applied mathematics. Covers elementary partial differential equations in the engineering and physical sciences. Simple models (heat flow, vibrating strings, and membranes) are emphasized. Discusses method of separation of variables, Fourier series, methods of characteristics for linear wave equations, introduction to finite-difference numerical methods for partial differential equations, and other topics.

50:640:465. INTRODUCTION TO THE FUNDAMENTALS OF MATHEMATICS (3)
Prerequisite: Permission of instructor.
Selected topics from the different areas of mathematics.

50:640:472. SPECIAL FUNCTIONS (3)
Prerequisite: 50:640:314.
Theory and applications of functions frequently used in modern analysis such as the gamma function, delta function, Green's functions, Legendre functions, Bessel functions, Schwarz distributions, and others.

50:640:477-478. MATHEMATICAL THEORY OF PROBABILITY (3,3)
Prerequisites: 50:640:121 and 50:960:336 or permission of instructor.
Mathematical theory of discrete and continuous probabilities.

50:640:491,492. MATHEMATICS SEMINAR I,II (3,3)
Prerequisite: Permission of instructor.
Members of the seminar present individually developed reports on topics of mathematical interest.

50:640:493-494. INDIVIDUAL STUDY IN MATHEMATICS (BA,BA)

50:640:495-496. HONORS PROGRAM IN MATHEMATICS (3,3)

Courses (Statistics 960)

50:960:183. ELEMENTARY APPLIED STATISTICS (R) (3)
No prerequisite beyond the usual three years of high school mathematics.
Credit will not be given for both this course and 50:830:215.
Frequency distribution, graphical representations, measures of central tendency and variability, elements of probability, the normal curve and its applications, sample versus population, estimating and testing hypotheses, regression and correlation analysis, nonparametric tests. Emphasis on applications.

50:960:283. INTRODUCTION TO STATISTICS I (R) (3)
Prerequisite: 50:640:121 or 130. Intended primarily for business majors and information systems/computer science majors.
Elementary course in the principles and methods of statistics. Topics include measures of central tendency and dispersion, probability theory, random variables and probability distribution, binomial and normal distributions, central limit theorem, confidence intervals, and testing of hypotheses on mean(s) and proportion(s).

50:960:284. INTRODUCTION TO STATISTICS II (R) (3)
Prerequisite: 50:960:283. Intended primarily for business majors and information systems/computer science majors.
A second introductory statistics course. Emphasizes the application of statistical techniques to data analysis. Topics include analysis of variance, nonparametric statistics, simple linear regression, correlation, multiple regression, time series, and index numbers.

50:960:336. APPLIED STATISTICS (3)
Prerequisite: 50:640:122. Intended primarily for applied mathematics majors but open to all qualified students.
Descriptive statistics, probability, random variables, probability distributions, estimation and tests of hypotheses, regression and correlation analysis. Emphasis on applications of these techniques to problems in the biological, physical, and social sciences.

50:960:337. MANAGERIAL STATISTICS (INTERMEDIATE) (3)
Prerequisite: 50:960:283 or permission of instructor.
An intermediate course oriented to business and managerial decisions and research in social sciences. Statistical decision making, *a priori* and *a posteriori* probabilities, quality control sampling, power curve solutions, sequential decisions, and research design. Design of sample surveys and study of replicated sampling plans.

50:960:340. SPECIAL TOPICS IN STATISTICS (3)
Prerequisite: 50:960:284.
Aimed at students with any major who want to go beyond the first two statistics courses. Instructor provides proper description.

50:960:384. STATISTICAL DATA ANALYSIS (3)
Prerequisite: 50:960:284.
Aimed at students who want to go beyond the first two statistics courses. Application of statistical techniques to analyze data. Topics include correlation and regression analysis, regression diagnostics, model building, design of experiments, and categorical data analysis. Use of computer packages for visual analysis and interpretation of data.

50:960:390. INTRODUCTORY COMPUTING FOR STATISTICS (3)
Pre- and corequisites: 50:960:283, 284.
Aimed at students who want to learn statistical computing along with or after the second statistics course. Introduces statistical computing using packages (Excel, SAS, etc.). Includes computing basic univariate statistics, generating random numbers, computing point estimates and confidence interval, testing of hypothesis, basic ANOVA , and regression.

50:960:452. INTRODUCTION TO BIOSTATISTICS (3)
No prerequisite beyond the usual three years of high school mathematics.
Introduction to the principles and methods of statistical inference for advanced undergraduate and graduate students in biological sciences. Topics include discussion of random variables, probability distributions, population, sample, measures of central tendency and dispersion, point and interval estimation, testing hypothesis, two-sample comparison, analysis of variance, linear regression and correlation model, and nonparametric methods. Emphasizes applications of statistical principles and analyses for biological sciences.

50:960:467. INTRODUCTION TO APPLIED MULTIVARIATE ANALYSIS (3)
Prerequisite: 50:960:284.
Aimed at students with any major who want to go beyond the first two statistics courses. Introduction to applied multivariate analysis through multivariate normal distribution. Topics include comparison of mean vector, multiple linear regression, discriminant analysis, principal components, factor analysis, and other applied multivariate topics. Use of statistical packages to perform all the multivariate computation and its interpretation.

50:960:476. INTRODUCTION TO SAMPLING (3)
Prerequisite: 50:960:283 or 336 or permission of instructor.
Application of the principles of sampling to economic procurement or assessment of data. Introduction to various sampling procedures. Emphasis on the design and control phases of investigation. Applications of the techniques to large-scale surveys, accounting and auditing, and operations research.

50:960:481,482. MATHEMATICAL THEORY OF STATISTICS (3,3)
Prerequisite: First course in calculus or permission of instructor.
First term: theory of probability, discrete and continuous probability distributions, introduction to statistical inference. *Second term:* further study of distribution functions, correlation and regression, analysis of variance and design of experiments, nonparametric methods, sequential sampling.

50:960:483. STATISTICAL QUALITY CONTROL (3)
Prerequisite: 50:960:283 or permission of instructor.
Basic course in modern statistical quality control. Statistical measures, histogram analysis, construction and analysis of control charts for variables and attributes, use of Dodge-Roming and military standards acceptance sampling plans, statistical aspects of tolerances.

50:960:484. STATISTICAL COMPUTING BY SAS (3)
Pre- and corequisites: 50:960:283, 284.
Aimed at students who want to learn statistical computing along with or after the second statistics course. Topics include introduction to SAS for reading data, creating datasets, and handling other data steps. Using SAS to perform basic regression and model building techniques. Carrying out ANOVA procedures for different design of experiments. Exposure to basic analysis of categorical, time series, and other types of data.

50:960:485-486. NUMBER PROBLEMS IN MATHEMATICAL THEORY OF STATISTICS (2,2)
To be used as laboratory in conjunction with 50:960:481,482.
Numerical problems applied to data in student's field of study where possible. Emphasis on application of mathematical statistical distributions and methods.

50:960:487-488. INTRODUCTION TO OPERATIONS RESEARCH (3,3)
Prerequisites: 50:960:283, 284, or permission of instructor.
A two-term introduction to techniques of operations research involved in construction and solution of models in inventory, linear programming, nonlinear programming, queuing, sequencing, network, replacement, reliability, Markov chains, and competitive problems.

50:960:490. EXPERIMENTAL DESIGN AND ANALYSIS (3)
Prerequisites: 50:960:283, 284, or permission of instructor.
An advanced course in statistics with applications in all fields of study. Analysis of variance and covariance, experimental framework and layout, simple randomized designs, randomized blocks. Latin squares, Graeco-Latin squares, factorials, balanced and partially balanced designs, gains in precision and estimation.

50:960:495. INDEPENDENT STUDY IN STATISTICS (3)
Prerequisites: 50:960:283, 284, and permission of instructor.
Intended for students who want to concentrate on special methods of statistical analysis and their applications to real world problems.

50:960:496. INDEPENDENT STUDY IN OPERATIONS RESEARCH (3)
Prerequisites: 50:960:487-488 and permission of instructor.
Intended to meet the needs of students who wish to study special techniques of operations research beyond the level of 50:960:487-488, or their applications to real world problems.